

[Pages for USGS annual report]



Concentrations of wastewater and human-affected organic compounds in ground-water samples from selected sites at and near a former landfill near Elkhart, Indiana

Ground-water samples were collected during November 2000 and October 2002 from four wells at and near a former landfill to determine concentrations of wastewater affected compounds. These compounds include:

- Antibiotics, including those that are used for veterinary and/or human health (including select aminoglycosides, beta-lactams, fluoquinolones, macrolides, sulfonamides, and tetracyclines).
- A set of prescription and nonprescription drugs used for human health (for example, acetaminophen, cimetidine, ibuprofen, ranitidine, and trimethoprim), and
- A broad spectrum of industrial and household wastewater products (including select antioxidants, detergents, disinfectants, and plasticizers).

Ground-water samples were collected from three wells on November 15-16, 2000; two wells on the landfill property and from a domestic well in an adjoining neighborhood (fig. 1; table 1). Samples were collected from two wells on October 31, 2002 (115A and 116A) to expand and verify the results of the 2000 sampling. Original plans were to resample well 101A but that well was dry at the time of sampling; nearby well 115A was substituted.

Staff that performed the sampling were required to abstain from use of selected personal care and food products including (i.e. insect repellents, colognes, perfumes), caffeinated products, and tobacco for three days before sampling and during sample collection and processing. The wells were sampled using procedures documented in Wilde and others (2001). Briefly, wells were pumped using a stainless steel Fultz submersible pump equipped with Teflon hose and fittings. Water was sampled when probe-measured field parameter values (pH, specific conductance and temperature) of ground water produced from the wells were observed to stabilize in flow-cell based measurements. Water samples for each chemical analysis were collected and stored in amber, baked-glass bottles. The samples were chilled immediately after collection and sent to the National Water Quality Laboratory for processing.

All samples were filtered at the laboratory before extraction and analysis through a 0.7 mm pore-size, baked, glass-fiber filter. Four separate analytical methods were used to measure concentrations of the target chemicals in the ground water samples. Those methods are described or referenced in Kolpin and others (2002) and Barnes and others (2002).

Table 1. Characteristics of wells sampled for analysis of wastewater and human-affected contaminants near Elkhart, Indiana.

{-, not available; PVC, polyvinylchloride: mm/dd/yyyy, date in month, day and year format; uS/cm, microSiemens per centimeter; deg C, degrees Celsius}

Station number	Well number	Latitude	Longitude
414216086001701	HIMCO LF 116A AT ELKHART, IN	41 42'15"	86 00'17"
414215086001702	USEPA WELL 101A AT HIMCO LANDFILL AT ELKHART, IN	41 42'16"	86 00'17"
USEPA WELL 115A	USEPA WELL 115A AT HIMCO LANDFILL AT ELKHART, IN	--	--
414218086001101	54305 WESTWOOD DRIVE AT ELKHART, IN RESIDENTIAL WELL	41 42'18"	86 00'11"

Station Number	Well depth, feet below ground surface	Casing diameter and material	Aquifer type	Date (mm/dd/yyyy)	Water level depth and date, depth in feet below top of casing
414216086001701	12.6	2 inch ID PVC	Unconfined	11/16/2000	11.35
414215086001702	19.8	2 inch ID PVC	Unconfined	10/31/2002	11.61
USEPA WELL 115A	17.4	2 inch ID PVC	Unconfined	11/16/2000	12.45
414218086001101	Could not access to measure	Unknown	Unconfined	10/31/2002	14.33
					Could not access to measure

Station Number	Date	Specific Conductance (US/CM) (1)	pH, Whole Water (Standard Units) (1)	TEMPERATURE, WATER (DEG C) (1)
414216086001701	11/16/2000	3386	6.70	12.84
	10/31/2002	3302	9.44	13.84
414215086001702	11/16/2000	1220	7.01	13.06
USEPA WELL 115A	10/31/2002	1512	8.88	12.43
414218086001101	10/31/2002	711	7.24	13.63

(1) Field parameter data reported by USGS for 2000 samples and by USEPA for 2002 samples (Douglas Yeskis, U.S. Environmental Protection Agency, written communication, November 1, 2002).

Table 2. Ground-water wells near Elkhart, Indiana sampled in 2000 and 2002 for selected industrial and household wastewater compounds.
 [None, no data or comment; mm/dd/yyyy, date in month, day and year format; hhmm, time in hour and minute, 24 hour format; ug/L micrograms per liter; <, less than;
 ND, not detected in sample, minimum detection level not reported]

Parameter or compound name	Reporting units	different, in parenthesis)	Station Name				Analytical comments, with blank sample concentrations in parenthesis
			HIMCO LF 116A AT ELKHART, IN	HIMCO LF 116A AT ELKHART, IN	USEPA WELL 101A AT HIMCO	USEPA WELL 115A AT HIMCO	
Station Identifier		414218086001101	414216086001701	414216086001701	414215086001702		None
Collection Date	mm/dd/yyyy	11/15/2000	11/16/2000	10/31/2002	11/16/2000	10/31/2002	
Collection Time	hhmm	1630	1115	1400	1320	1500	
Industrial and Household Wastewater Products							
Acetophenone	ug/L	< 0.220	< 0.220	< 0.500	< 0.220	< 0.500	None
Anthraquinone	ug/L	--	--	< 0.500	--	< 0.500	None
Bis(2-ethyl hexyl) adipate	ug/L	< 2.000	< 2.000	--	< 2.000	--	None
Benzophenone	ug/L	--	--	< 0.500	--	E 0.069	None
5-methyl-1H-benzotriazole	ug/L	< 0.150	0.317	< 2.000	0.303	< 2.000	None
Bromoform	ug/L	--	--	< 0.500	--	< 0.500	None
Butylated hydroxyanisole (BHA)	ug/L	< 0.120	< 0.120	< 5.000	< 0.120	< 5.000	None
Butylated hydroxytoluene (BHT)	ug/L	< 0.110	< 0.110	--	< 0.110	--	None
Caffeine	ug/L	< 0.080	< 0.080	< 0.500	< 0.080	E 4.200	None
Camphor	ug/L	--	--	< 0.500	--	< 0.500	None
Carbazole	ug/L	--	--	< 0.500	--	< 0.500	None
Codeine	ug/L	< 0.200	< 0.200	--	< 0.200	--	None
Cotinine	ug/L	< 0.080	< 0.080	< 1.000	< 0.080	E 0.100	None
p-Cresol	ug/L	< 0.060	0.124	< 1.000	0.072	< 1.000	None
Cumene	ug/L	--	--	E 0.140	--	< 0.500	None
1,4-Dichlorobenzene	ug/L	< 0.040	0.313	E 0.190	0.076	< 0.500	None
3,4-Dichlorophenyl isocyanate	ug/L	--	--	< 0.500	--	< 0.500	None
N,N-Diethyltoluamide (DEET)	ug/L	< 0.080	0.462	E 0.380	0.241	E 0.280	None

Table 2. Ground-water wells near Elkhart, Indiana sampled in 2000 and 2002 for selected industrial and household wastewater compounds—Continued

Parameter or compound name	Reporting units	different, in parenthesis)	Station Name					Analytical comments, with blank sample concentrations in parenthesis
			HIMCO LF 116A AT ELKHART, IN	HIMCO LF 116A AT ELKHART, IN	USEPA WELL 101A AT HIMCO	USEPA WELL 115A AT HIMCO		
Station Identifier		414218086001101	414216086001701	414216086001701	414215086001702		None	
Collection Date	mm/dd/yyyy	--	11/15/2000	11/16/2000	10/31/2002	11/16/2000	10/31/2002	
Collection Time	hhmm	--	1630	1115	1400	1320	1500	
Industrial and Household Wastewater Products								
2,6-Dimethylnaphthalene	ug/L	--	--	< 0.500	--	--	< 0.500	None
Ethyl citrate	ug/L	--	--	< 0.500	--	--	E 0.077	None
Galaxolide (HHCB)	ug/L	--	--	< 0.500	--	--	E 0.085	None
Indole	ug/L	--	--	< 0.500	--	--	< 0.500	None
Isoborneol	ug/L	--	--	< 0.500	--	--	< 0.500	None
Isoquinoline	ug/L	--	--	< 0.500	--	--	< 0.500	None
d-Limonene	ug/L	--	--	< 0.500	--	--	< 0.500	None
Menthol	ug/L	--	--	< 0.500	--	--	E 0.094	None
1-Methylnaphthalene	ug/L	--	--	< 0.500	--	--	< 0.500	None
2-Methylnaphthalene	ug/L	--	--	< 0.500	--	--	< 0.500	None
Methyl salicylate	ug/L	--	--	< 0.500	--	--	< 0.500	None
Naphthalene	ug/L	< 0.025	< 0.025	< 0.500	< 0.025	< 0.500	< 0.500	None
Bisphenol A	ug/L	< 0.090	1.29	E 0.540	0.69	E 0.360	Detected in 2002 equipment rinse blank sample (E 0.1)	
4-Cumylphenol	ug/L	--	--	< 1.000	--	--		
Pentachlorophenol	ug/L	--	--	< 2.000	--	--		
Phenol	ug/L	< 0.450 (E 0.314)	< 0.450	< 0.500	E 0.511	< 0.500	None	

Table 2. Ground-water wells near Elkhart, Indiana sampled in 2000 and 2002 for selected industrial and household wastewater compounds—Continued

Parameter or compound name	Reporting units	54305 WESTWOOD DRIVE AT ELKHART, IN RESIDENTIAL WELL (Result from duplicate sample, if different, in parenthesis)	Station Name				Analytical comments, with blank sample concentrations in parenthesis
			HIMCO LF 116A AT ELKHART, IN	HIMCO LF 116A AT ELKHART, IN	USEPA WELL 101A AT HIMCO LANDFILL AT ELKHART, IN	USEPA WELL 115A AT HIMCO LANDFILL AT ELKHART, IN	
Station Identifier		414218086001101	414216086001701	414216086001701	414215086001702		None
Collection Date	mm/dd/yyyy	11/15/2000	11/16/2000	10/31/2002	11/16/2000		10/31/2002
Collection Time	hhmm	1630	1115	1400	1320		1500
Industrial and Household Wastewater Products							
Nonylphenol monoethoxylate-total (NPEO1)	ug/L	< 1.000	E 0.774	< 5.000	E 0.941	E 3.800	None
Nonylphenol monoethoxylate-total (NPEO2)	ug/L	< 1.100	< 1.100	< 5.000	E 1.460	E 0.890	None
4-n-Octylphenol	ug/L	--	--	< 1.000	--	< 1.000	None
4-tert-Octylphenol	ug/L	--	--	< 1.000	--	< 1.000	None
Octylphenol monoethoxylate (OPEO1)	ug/L	< 0.120	E 0.166	< 1.000	E 0.260	E 0.280	Detected in 2002 laboratory blank sample (E 0.13)
Octylphenol diethoxylate (OPEO2)	ug/L	< 0.200	< 0.200	< 1.000	< 0.200	< 1.000	None
2,6-di-t-Butylphenol	ug/L	< 0.150	< 0.150	--	< 0.150	--	None
p-Nonylphenol-total	ug/L	< 0.700	E 1.450	< 5.000	E 0.330	E 1.800	None
2,6-di-t-p-Benzoquinone	ug/L	< 0.500	E 0.965	--	< 0.500	--	None
Skatol	ug/L	--	--	< 1.000	--	< 1.000	None
Tetrachloroethylene	ug/L	< 0.030	< 0.030	< 0.500	< 0.030	< 0.500	None
Triclosan	ug/L	E 0.040 (E 0.041)	< 0.050	< 1.000	E 0.036	E 0.260	Detected in 2000 laboratory blank sample (E 0.044)
Tonalide (AHTN)	ug/L	--	--	< 0.500	--	E 0.330	None

Table 2. Ground-water wells near Elkhart, Indiana sampled in 2000 and 2002 for selected industrial and household wastewater compounds—Continued

Parameter or compound name	Reporting units	different, in parenthesis)	Station Name				Analytical comments, with blank sample concentrations in parenthesis
			HIMCO LF 116A AT ELKHART, IN	HIMCO LF 116A AT ELKHART, IN	USEPA WELL 101A AT HIMCO LANDFILL AT ELKHART, IN	USEPA WELL 115A AT HIMCO LANDFILL AT ELKHART, IN	
Station Identifier		414218086001101	414216086001701	414216086001701	414215086001702		None
Collection Date	mm/dd/yyyy	11/15/2000	11/16/2000	10/31/2002	11/16/2000		10/31/2002
Collection Time	hhmm	1630	1115	1400	1320		1500
Herbicides and Pesticides							
Atrazine	ug/L	--	--	< 0.500	--	< 0.500	None
Bromacil	ug/L	--	--	< 0.500	--	< 0.500	None
Carbaryl	ug/L	< 0.060	< 0.060	< 1.000	< 0.060	< 1.000	None
cis-Chlordane	ug/L	< 0.040	< 0.040	--	< 0.040	--	None
Chlorpyrifos	ug/L	< 0.020	< 0.020	< 0.500	< 0.020	< 0.500	None
Diazinon	ug/L	< 0.030	< 0.030	< 0.500	< 0.030	< 0.500	None
Dichlorvos	ug/L	--	--	< 1.000	--	< 1.000	None
Dieldrin	ug/L	< 0.080	< 0.080	--	< 0.080	--	None
Lindane	ug/L	< 0.050	< 0.050	--	< 0.050	--	None
Metalaxyl	ug/L	--	--	< 0.500	--	< 0.500	None
Metolachlor	ug/L	--	--	< 0.500	--	< 0.500	None
Methyl parathion	ug/L	< 0.060	< 0.060	--	< 0.060	--	None
Prometon	ug/L	--	--	< 0.500	--	< 0.500	None
Polynuclear Aromatic Hydrocarbons							
Anthracene	ug/L	< 0.060	E 0.034	< 0.500	< 0.060	< 0.500	None
Fluoranthene	ug/L	< 0.030	< 0.030	E 0.076	< 0.030	< 0.500	None
Phenanthrene	ug/L	< 0.050	< 0.050	< 0.500	< 0.050	< 0.500	None
Pyrene	ug/L	< 0.030	< 0.030	< 0.500	< 0.030	< 0.500	None
Benzo(a)pyrene	ug/L	< 0.070	< 0.070	< 0.500	< 0.070	< 0.500	None

Table 2. Ground-water wells near Elkhart, Indiana sampled in 2000 and 2002 for selected industrial and household wastewater compounds—Continued

Parameter or compound name	Reporting units	different, in parenthesis)	Station Name				Analytical comments, with blank sample concentrations in parenthesis
			HIMCO LF 116A AT ELKHART, IN	HIMCO LF 116A AT ELKHART, IN	USEPA WELL 101A AT HIMCO LANDFILL AT ELKHART, IN	USEPA WELL 115A AT HIMCO LANDFILL AT ELKHART, IN	
Station Identifier		414218086001101	414216086001701	414216086001701	414215086001702	None	
Collection Date	mm/dd/yyyy	11/15/2000	11/16/2000	10/31/2002	11/16/2000	10/31/2002	
Collection Time	hhmm	1630	1115	1400	1320	1500	
Industrial and Household Wastewater Products							
Fire Retardants							
Tributylphosphate	ug/L	--	--	0.64	--	E 0.100	None
Tri(2-chloroethyl)phosphate	ug/L	0.649 (0.741)	0.238	E 0.160	0.206	E 0.130	None
Tri(dichloroisopropyl)phosphate	ug/L	< 0.100	< 0.100	E 0.120	< 0.100	< 0.500	None
Ethanol,2-butoxy-,phosphate	ug/L	< 0.200	0.948	E 0.890	0.215	E 0.220	None
PBDE4-1	ug/L	--	--	< 10.000	--	< 10.000	None
PBDE4-2	ug/L	--	--	< 10.000	--	< 10.000	None
PBDE4-3	ug/L	--	--	< 10.000	--	< 10.000	None
PBDES-1	ug/L	--	--	< 10.000	--	< 10.000	None
PBDES-2	ug/L	--	--	< 10.000	--	< 10.000	None
PBDES-3	ug/L	--	--	< 10.000	--	< 10.000	None
PBDE6-1	ug/L	--	--	< 10.000	--	< 10.000	None
PBDE6-2	ug/L	--	--	< 10.000	--	< 10.000	None
Plasticizers							
Diethylphthalate	ug/L	< 0.350	< 0.350	< 0.500	E 5.280	1.2	None
Diethylhexyl phthalate	ug/L	--	--	< 0.500	--	< 0.500	Detected in 2002 laboratory blank sample (E 1.0)
Bis(2-ethylhexyl) phthalate	ug/L	E 3.620 (< 2.500)	E 3.260	--	< 2.500	--	None
Phthalic anhydride	ug/L	< 0.350	< 0.350	--	E 1.150	--	None
Triphenyl phosphate	ug/L	< 0.100	< 0.100	< 0.500	< 0.100	< 0.500	None

Table 2. Ground-water wells near Elkhart, Indiana sampled in 2000 and 2002 for selected industrial and household wastewater compounds—Continued

Parameter or compound name	Reporting units	different, in parenthesis)	Station Name				Analytical comments, with blank sample concentrations in parenthesis
			HIMCO LF 116A AT ELKHART, IN	HIMCO LF 116A AT ELKHART, IN	USEPA WELL 101A AT HIMCO	USEPA WELL 115A AT HIMCO	
Station Identifier		414218086001101	414216086001701	414216086001701	414215086001702		None
Collection Date	mm/dd/yyyy	11/15/2000	11/16/2000	10/31/2002	11/16/2000		10/31/2002
Collection Time	hhmm	1630	1115	1400	1320		1500
Hormones							
3B-Coprostanol	ug/L	< 0.600	< 0.600	E 0.350	< 0.600	E 2.000	None
Cholesterol	ug/L	< 1.500	< 1.500	E 0.640	< 1.500	E 3.700	None
Stigmastanol	ug/L	< 2.000	< 2.000	< 2.000	< 2.000	< 2.000	None
beta-Sitosterol	ug/L	--	--	< 2.000	--	E 1.400	None

Table 3. Ground-water wells near Elkhart, Indiana sampled in 2000 and 2002 for selected pharmaceutical compounds.

[None, no data or comment; mm/dd/yyyy, date in month, day and year format; hhmm, time in hour and minute, 24 hour format; ug/L micrograms per liter; <, less than; ND, not detected in sample, minimum detection level not reported]

Parameter or pharmaceutical name	Reporting units	Station Name						Analytical comments, with blank sample concentrations in parenthesis
		54305 WESTWOOD DRIVE AT ELKHART, IN RESIDENTIAL WELL	HIMCO LF 116A AT ELKHART, IN	HIMCO LF 116A AT ELKHART, IN	USEPA WELL 101A AT HIMCO LANDFILL AT ELKHART, IN	USEPA WELL 115A AT HIMCO LANDFILL AT ELKHART, IN		
Station Identifier		414218086001101	414216086001701	414216086001701	414215086001702		None	
Collection Date	mm/dd/yyyy	11/15/2000	11/16/2000	10/31/2002	11/16/2000		10/31/2002	
Collection Time	hhmm	1630	1115	1400	1320		1500	
Acetaminophen	ug/L	0.38	< 0.009	< 0.009	0.022	< 0.009	Detected in 11/16/2000 field blank (0.019)	
Amoxicillin	ug/L	ND	ND	--	ND	--	None	
Azithromycin	ug/L	--	--	ND	--	ND	None	
Caffeine	ug/L	E 0.129	< 0.024	< 0.024	E 0.0037	< 0.024	Detected in 11/16/2000 field blank (0.019), and 10/31/2002 equipment rinsate blank (0.0025)	
Carbamazepine	ug/L	--	--	ND	--	ND	None	
Cephalexin	ug/L	ND	ND	--	ND	--	None	
Cimetidine	ug/L	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	None	
Clarithromycin	ug/L	--	--	--	--	--	None	
Codeine	ug/L	< 0.024	< 0.024	< 0.024	< 0.024	< 0.024	None	
Cotinine	ug/L	0.001	< 0.023	< 0.023	< 0.023	< 0.023	< 0.023	None
Dehydronifedipine	ug/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	None	
Digoxin	ug/L	< 0.026	< 0.026	--	< 0.026	--	None	
Digoxigenin	ug/L	< 0.008	< 0.008	--	< 0.008	--	None	

Table 3. Ground-water wells near Elkhart, Indiana sampled in 2000 and 2002 for selected pharmaceutical compounds—Continued

Table 4. Ground-water wells near Elkhart, Indiana sampled in 2000 and 2002 for selected antibiotic compounds
[mm/dd/yyyy, date in month, day and year format; hhmm, time in hour and minute, 24 hour format; <, less than]

Parameter or antibiotic name	Reporting units	Station Name		
		54305 WESTWOOD DRIVE AT ELKHART, IN RESIDENTIAL WELL	HIMCO LF 116A AT ELKHART, IN	USEPA WELL 101A AT HIMCO LANDFILL AT ELKHART, IN
Station identifier		414218086001101	414216086001701	414215086001702
Date	mm/dd/yyyy	11/15/2000	11/16/2000	11/16/2000
Time	hhmm	1630	1115	1320
Carbadox	ug/L	<0.1	<0.1	<0.1
Chlortetracycline	ug/L	<0.05	<0.05	<0.05
Ciprofloxacin	ug/L	<0.02	<0.02	<0.02
Doxycycline	ug/L	<0.1	<0.1	<0.1
Enrofloxacin	ug/L	<0.02	<0.02	<0.02
Erythromycin-H2O	ug/L	<0.05	<0.05	<0.05
Lincomycin	ug/L	<0.05	<0.05	<0.05
Norfloxacin	ug/L	<0.02	<0.02	<0.02
Oxytetracycline	ug/L	<0.1	<0.1	<0.1
Roxithromycin	ug/L	<0.03	<0.03	<0.03
Sarafloxacin	ug/L	<0.02	<0.02	<0.02
Sulfachloropyradizine	ug/L	<0.1	<0.1	<0.1
Sulfadimethoxine	ug/L	<0.05	<0.05	<0.05
Sulfamerazine	ug/L	<0.05	<0.05	<0.05
Sulfamethazine	ug/L	<0.05	<0.05	<0.05
Sulfamethizole	ug/L	<0.1	<0.1	<0.1
Sulfamethoxazole	ug/L	<0.1	<0.1	<0.1
Sulfathiazole	ug/L	<0.1	<0.1	<0.1
Tetracycline	ug/L	<0.05	<0.05	<0.05
Trimethoprim	ug/L	<0.03	<0.03	<0.03
Tylosin	ug/L	<0.05	<0.05	<0.05
Virginiamycin	ug/L	<0.1	<0.1	<0.1

REFERENCES CITED:

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